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## Observations on Antidromy.

BY GEORGE MACLOSKIE.

It was stated in the BULLETIN of September and November, 1895, that every species of flowering plant, including Gymnosperms, appears to have two castes of individuals, which are two reversed counterparts of each other, as our right and left hands are. This 'antidromic' diversity is evidently a primitive character, and seems to pervade the whole organization of the plant; so that when it is masked or disturbed by secondary changes in one part we may detect it in others. Thus in *Berberis* and in *Cardamine* you may find it difficult to determine the antidromic phyllotaxy, but the order of flowers in the racemes is manifestly antidromic. The opposite leaves of *Acer* render it difficult to trace the right course of the spiral, but here the anthotaxy assists, and also in the seedling we are guided by the position of the first pair of foliage-leaves relatively to the cotyledons, in some individuals crossing somewhat to the right, in others somewhat to the left, when the same orientation is maintained. Whether we do or do not know the real significance, the facts themselves are too definite to be any longer overlooked; and my present contribution is designed to add some new observations which must be taken account of as part of the data.

*Erythronium* is a good illustration of the unexpected way in which the evidence may come up. Hold the plant with the outer or sheathing leaf towards you, then some of the plants have the solitary flower nodding over to your right, and others have it nodding to your left. Spring-beauty (*Claytonia Virginica*) carries the same system further, and also introduces an additional factor. Hold a specimen with the two fleshy leaves next you, and note that the lowest flower arises to your right side from the peduncle, the bract arising towards your left side; another specimen held in the same way has the first flower on your left side, and order of bracts and subsequent flowers antidromic as compared with the first specimen. A new point in this is that the same tuber may have half a dozen plants, which are half and half of each caste according to some definite law. Thus the derivatives of the same tuber appear to be relatively antidromic, like the embryos pro-

duced by seeds from opposite sides of the same carpel. In my first paper I referred to *Iris* and to *Richardia* as having antidromic plants from the same rootstock; and now I find this to be the general system. Thus the skunk cabbage (*Symplocarpus foetidus*), of the same order as *Richardia*, has the spathes of a single plant always of the same kind; but nearly always the same clump has plants differing in the order of phyllotaxy and in the form of the spathes. In *Helonias* (of Liliaceae) the thick rootstock bifurcates so as to have two arms like the letter Y; and if you hold it with the branches of the Y towards you, the plant or plants borne on the branch next your right hand are evolved counter-clockwise (*i. e.*, with dextrorse phyllotaxy), whilst the plant or plants borne on the branch next your left hand are evolved clock-wise or sinistrorsely. This is as was noted in *Iris*, which belongs to a different order of plants. The two or three flowers along one arm being of the same caste remind us of the seeds borne on one valve of a bean-pod being alike to each other and being the antidromes of those on the opposite valve. In *Podophyllum* the examination is more troublesome, but so far as I can determine the result is the same. If we hold the plant with the smaller of the peltate leaves next us, then the uppermost of the sub-leaves (*niederblätter*) at the base of the stalk is next us, its tip towards our right and the other sub-leaves following in definite order in one plant, and all these relations reversed in another plant. In one plant thus held, the flower starting from the fork of its stalk turns to my right hand and in another to my left hand; the flower to my right has its most prominent sepal and its placenta distad-dextrad, and in the other plant these parts are distad-sinistrad. This diversity can be observed in very young plants starting from the ground. (In one specimen I found two flowers turning right and left respectively.) Now the underground stem sometimes bifurcates, one of its branches bearing one or more plants which are the antidromes of those borne by the other branch. In the same clump of *Carex* we find different individuals with antidromic phyllotaxy and antidromic order of evolution of flower-spikes. Perhaps these observations may cast some light upon the curious case of *Liquidambar* where the same tree may have antidromic branches; whilst some definite law seems to hold in them all.

The case of *Viola* may be cited because of its difficulty. The leafy stemmed Violets baffle us because of the angle of divergence being nearly that of a semicircle; the rosettes of the stemless species are not easily resolved, but in some cases, as *V. lanceolata*, etc., they seem to be antidromic. The flower on each peduncle being solitary, we can get no aid from the anthotaxy. The spur of the flowers furnishes a landmark, but whether this is antidromic or only of recent origin I have not been able to prove. If you hold a violet-flower with the spur towards you, in some cases the spur will protrude to your right of the pedicel, in other cases it will protrude towards your left.

This distinctive peculiarity cannot arise from the direct influence of sunlight, as it is shown by the very young flower-bud. I have not succeeded in correlating it with antidromic phyllotaxy; but generally all the flowers of one plant appear to be of the same caste, and the flowers of different plants from the same rootstock appear to differ. But the case is complex; thus a fleshy rootstock of *V. pedata* had four fleshy branches, each of them bearing a number of plants; branch 1 and 2 had each three flowers, two of them with spur to right, one with spur to left, and phyllotaxy dextrose; branch 3 was in all respects the converse of the others, and branch 4 was small and bore no flowers. Possibly the quasi-antidromy of these may be of the same character as in *Hibiscus*, where the same branch may have flowers twisted in contrary directions; this explanation may apply also to the cases reported to me by my friend, Arthur K. Harrison, of Lebanon Springs, N. Y., about the catkins of birches and *Ostrya*, of which he writes: "Whenever they occur in pairs it is the rule for one to be dextral and the other sinistral, the whorl in each rolling outward from the axis as viewed from the upper (inner) side of the branch; where there are three or more aments the central (end) one whorls sometimes one way, sometimes the other, depending, I think, upon which side of the branch they originate from," and he thinks the same rule applies to all species bearing terminal clustered catkins.

In my paper of November last I referred tentatively to some facts that seem to introduce the Ferns into the realm of antidromy. This view is confirmed by observations on the veneration of Cinnamon-Osmund. The fronds, in starting in the center of the

plant, arise clockwise in some plants and counter-clockwise in others. I think that *Isoetes* affords similar evidence; but I have not been able to satisfy myself on this point.

The rootstock of the yellow waterlily (*Nuphar*) shows in its leaf-scars the order of development of the leaves to be distinctly antidromic as between two segments borne by the same stock; in the specimen before me the leaf-scars on the mother stock and on the right arm of the Y-like rootstock are arranged in sinistrorse order, whilst those on the left arm are dextrorse. The following extract from a letter sent by my young friend, Professor Francis E. Lloyd, of Pacific University, Oregon, is very interesting, as it gives a connecting link between the antidromy of *Liquidambar* and that of rootstocks,—“I find that *Acer circinatum*, a plant of very singular habit, shows antidromy as between branch and branch in dichotomy. I am not sure of any observations. The plant is a shrub or small tree, and branches dichotomously with great regularity and the two branches of the Y twist to the right and left respectively.” This is precisely as in the rhizome of *Helonias*. Professor Lloyd promises to report his observations; and I hope he will extend them to other plants on the Pacific coast.

PRINCETON COLLEGE, May 19, 1896.

## New Species of Fungi from Mississippi.

BY S. M. TRACY AND F. S. EARLE.

In the BULLETIN for May, 1895, the writers described a number of new species of parasitic fungi, nearly all of which had been collected in Mississippi. During the past year we have identified a number of additional species, which are described here. Type specimens of all are in the herbaria of the authors, and of nearly all in the herbaria of the Department of Agriculture, Rutgers College, and Columbia and Harvard Universities.

### CERCOSPORA CORNICOLA n. sp.

Epiphyllous, on irregular brown deadened spots without a definite border, 5–10 mm. Hyphae densely clustered from a nodular base, very short, continuous, somewhat flexuous, olivaceous, 11–15 by 3–4  $\mu$ ; conidia slender, thread-like, somewhat